

WHAT IS CLAIMED IS:

- 5                   1. A method for treating liquid, comprising the steps of:  
directing a stream of liquid into a cyclone apparatus having an inlet  
closed to the atmosphere and a submerged outlet;  
forming a liquid vortex along an inner surface of the cyclone  
apparatus; and
- 10                   forming a central portion substantially evacuated of gases to create a  
near vacuum condition within the cyclone apparatus and defined by an inner  
surface of the liquid vortex.
- 15                   2. The method of claim 1, including the step of pressurizing the liquid  
upstream of the cyclone apparatus.
- 20                   3. The method of claim 1, including the step of subjecting the liquid  
exiting the cyclone apparatus to collision and cavitation forces.
- 25                   4. The method of claim 3, wherein the cyclone apparatus includes a  
tapered body such that the outlet is of a smaller cross-sectional area than an  
upper portion thereof.
5. The method of claim 4, wherein the outlet of the cyclone apparatus  
is defined by a knife edge.
6. The method of claim 1, including the step of measuring pressure  
levels of the evacuated central portion.

7. The method of claim 6, wherein the pressure is measured using a pressure sensor or gauge in communication with the evacuated central portion through a port of the cyclone apparatus.

5                   8. The method of claim 1, including the step of selectively adding treatment gas to the liquid vortex through the evacuated central portion.

                  9. The method of claim 8, wherein the step of adding treatment gas is performed so as not to disrupt the near vacuum condition of the evacuated  
10                   central portion.

                  10. The method of claim 1, including the step of directing photon energy through the evacuated central portion and into the liquid vortex.

15                   11. The method of claim 10, wherein the photon energy is directed into the liquid vortex by means of a photon generator positioned out of contact with the liquid vortex.

                  12. The method of claim 11, wherein the photon generator is  
20                   positioned at an upper end of the cyclone apparatus above the liquid vortex and separated therefrom by a barrier having means for allowing the photon energy to pass therethrough and into the evacuated portion and liquid vortex.

                  13. The method of claim 12, wherein the photon generator comprises  
25                   an ultraviolet lamp disposed on the upper end of the cyclone device and including a reflector for focusing the photon energy therefrom through an aperture of the barrier and into the evacuated central portion and into the liquid vortex.

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14. A method for treating liquid, comprising the steps of:

directing a pressurized stream of liquid into a cyclone apparatus having an inlet closed to the atmosphere and a submerged outlet, the cyclone having a body which is tapered such that the outlet is of smaller cross-sectional area than an upper portion thereof;

forming a liquid vortex along an inner surface of the cyclone apparatus;

forming a central portion substantially evacuated of gases to create a near vacuum condition within the cyclone apparatus and defined by an inner surface of the liquid vortex; and

subjecting the liquid exiting the cyclone apparatus to collision and cavitation forces.

15. The method of claim 14, wherein the outlet of the cyclone apparatus is defined by a knife edge.

16. The method of claim 14, including the step of measuring pressure levels within the evacuated central portion using a pressure sensor or gauge in communication with the evacuated central portion through a port of the cyclone apparatus.

17. The method of claim 14, including the step of selectively adding treatment gas to the liquid vortex through the evacuated central portion.

18. The method of claim 17, wherein the step of adding treatment gas is performed so as not to disrupt the near vacuum condition of the evacuated central portion.

19. The method of claim 14, including the step of directing photon energy through the evacuated central portion and into the liquid vortex.

20. The method of claim 19, wherein the photon energy is directed into the liquid vortex by means of a photon generator positioned out of contact with the liquid vortex.

5                   21. The method of claim 20, wherein the photon generator is positioned at an upper end of the cyclone apparatus above the liquid vortex and separated therefrom by a barrier having means for allowing the photon energy to pass therethrough and into the evacuated portion and liquid vortex.

10                   22. The method of claim 21, wherein the photon generator comprises an ultraviolet lamp disposed on the upper end of the cyclone device and including a reflector for focusing the photon energy therefrom through an aperture of the barrier and into the evacuated central portion and into the liquid vortex.

15                   23. A method for treating liquid, comprising the steps of:  
directing a pressurized stream of liquid into a cyclone apparatus having an inlet closed to the atmosphere and a submerged outlet, the cyclone having a body which is tapered such that the outlet is of smaller cross-sectional  
20                   area than an upper portion thereof;  
forming a liquid vortex along an inner surface of the cyclone apparatus;  
forming a central portion substantially evacuated of gases to create a near vacuum condition within the cyclone apparatus and defined by an inner  
25                   surface of the liquid vortex; and  
selectively adding treatment gas to the liquid vortex through the evacuated central portion so as not to disrupt the near vacuum condition of the evacuated central portion.

24. The method of claim 23, including the step of subjecting the liquid exiting the cyclone apparatus to collision and cavitation forces.

5 25. The method of claim 23, wherein the outlet of the cyclone apparatus is defined by a knife edge.

10 26. The method of claim 23, including the step of measuring pressure levels within the evacuated portion using a pressure sensor or gauge in communication with the evacuated central portion through a port of the cyclone apparatus.

15 27. The method of claim 23, including the step of directing photon energy through the evacuated central portion and into the liquid vortex by means of a photon generator positioned out of contact with the liquid vortex.

20 28. The method of claim 27, wherein the photon generator is positioned at an upper end of the cyclone apparatus above the liquid vortex and separated therefrom by a barrier having means for allowing the photon energy to pass therethrough and into the evacuated portion and liquid vortex.

25 29. The method of claim 28, wherein the photon generator comprises an ultraviolet lamp disposed on the upper end of the cyclone device and including a reflector for focusing the photon energy therefrom through an aperture of the barrier and into the evacuated central portion and into the liquid vortex.

30. A method for treating liquid, comprising the steps of:  
directing a pressurized stream of liquid into a cyclone apparatus having an inlet closed to the atmosphere and a submerged outlet, the cyclone

having a body which is tapered such that the outlet is of smaller cross-sectional area than an upper portion thereof;

forming a liquid vortex along an inner surface of the cyclone apparatus; and

5                    forming a central portion substantially evacuated of gases to create a near vacuum condition within the cyclone apparatus and defined by an inner surface of the liquid vortex; and

10                   directing photon energy through the evacuated central portion and into the liquid vortex by means of a photon generator positioned out of contact with the liquid vortex.

31. The method of claim 30, including the step of subjecting the liquid exiting the cyclone apparatus to collision and cavitation forces.

15                   32. The method of claim 30, wherein the outlet of the cyclone apparatus is defined by a knife edge.

20                   33. The method of claim 30, including the step of measuring pressure levels of the evacuated central portion using a pressure sensor or gauge in communication with the evacuated central portion through a port of the cyclone apparatus.

25                   34. The method of claim 30, including the step of selectively adding treatment gas to the liquid vortex through the evacuated central portion.

30                   35. The method of claim 34, wherein the step of adding treatment gas is performed so as not to disrupt the near vacuum condition of the evacuated central portion.

36. The method of claim 30, wherein the photon generator is positioned at an upper end of the cyclone apparatus above the liquid vortex and separated therefrom by a barrier having means for allowing the photon energy to pass therethrough and into the evacuated portion and liquid vortex.

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37. The method of claim 36, wherein the photon generator comprises an ultraviolet lamp disposed on the upper end of the cyclone device and including a reflector for focusing the photon energy therefrom through an aperture of the barrier and into the evacuated central portion and into the liquid vortex.

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